

I claim:

1. A method for depositing a conductive material in the cavities of a substrate having a barrier layer and a seed layer formed thereon, the method comprising the steps of:

5 removing certain portions of the seed layer from the top surface of the substrate using a pad material while preventing removal of other portions of the seed layer from the cavities of the substrate;

exposing portions of the barrier layer on the top surface of the substrate after removing certain portions of the seed layer; and

10 depositing the conductive material on the seed layer in the cavities of the substrate.

2. A method according to claim 1, wherein the step of removing certain portions of the seed layer from the top surfaces of the substrate comprises the step of polishing the certain portions of the seed layer using the pad material having abrasive
15 particles.

3. A method according to claim 2, wherein the polishing step comprises rotating one of the pad material or the substrate in a circular direction at a rate of 50 to 2000 revolutions per minute for 2 to 60 seconds.

4. A method according to claim 2, wherein the polishing step comprises
20 rotating one of the pad material or the substrate in a circular direction at a rate of 100 to 1200 revolutions per minute for 5 to 25 seconds.

5. A method according to claim 2, wherein the polishing step comprises the step of using the pad material to make contact with the certain portions of the seed layer

on the top surface of the substrate at a pressure ranging from 0.05 to 5 pounds per inch.

6. A method according to claim 1, wherein the substrate comprises a dielectric layer.

7. A method according to claim 6, wherein the dielectric layer comprises a silicon dioxide layer.

8. A method according to claim 1, wherein the conductive material comprises one of a copper, aluminum, iron, nickel, chromium, indium, lead, tin, lead-tin alloys, nonleaded solderable alloys, silver, zinc, cadmium, titanium tungsten molybdenum, ruthenium, and combinations thereof.

9. A method for depositing conductive materials in the cavities of a substrate having a barrier layer and a seed layer formed thereon, the method comprising the steps of:

(1) selectively removing portions of the seed layer from a top surface of the substrate using a pad material while simultaneously applying a first conductive material on the seed layer in the cavities of the substrate;

(2) exposing portions of the barrier layer on the top surface of the substrate after selectively removing portions of the seed layer; and

(3) depositing a second conductive material in the cavities of the substrate.

10. A method according to claim 9, wherein step (1) further comprises the steps of:

polishing portions of the seed layer using an anode having attached thereto the pad material; and

applying a first electric current density between the anode and the substrate such

that the first conductive material is flowed from the pad material to the cavities of the substrate.

11. A method according to claim 10, wherein step (3) further comprises the step of applying a second electric current density between the anode and the substrate

5 such that the second conductive material is flowed from the pad material to the cavities of the substrate.

12. A method according to claim 11, wherein the first electric current density comprises 0.05 to 10 mA/cm².

10 13. A method according to claim 11, wherein the first conductive material is flowed at a rate of 0.1 to 5 gallons per minute.

14. A method according to claim 11, wherein the second electric current density comprises 5 to 250 mA/cm².

15 15. A method according to claim 9, wherein the first conductive material and the second conductive material comprise the same material.

16. A method according to claim 9, wherein the first conductive material comprises chrome and the second conductive material comprises of copper.

17. A method for depositing a plurality of conductive materials in the cavities of a substrate having a barrier layer and a seed layer formed thereon, the method comprising the steps of:

20 (3) depositing a first conductive material partially in the cavities and on the field regions of the substrate;

(4) removing the first conductive material from the field regions of the substrate;

and

(5) depositing a second conductive material on the first conductive material in the cavities.

18. A method according to claim 17, wherein the first conductive material comprises copper and the second conductive material comprises one of Cu-Sn and Cu-In.

5 19. A method according to claim 17, wherein the first conductive material is deposited using electro-deposition and the second conductive material is deposited using one of electroless deposition, electro-deposition, and CVD.

20. A method according to claim 17 further comprising the step of depositing a boundary layer between the first conductive material and the second conductive material such that the first conductive material does not intermix with the second conductive material.

21. A method according to claim 20, wherein the boundary layer comprises one of an alpha Ta, Cr, CoP, WCoP.

22. A method for forming a uniform overburden conductive layer using a conductive material on a substrate having a barrier layer and a seed layer formed thereon, the method comprising the steps of:

(1) depositing the conductive material in the cavities of the substrate while simultaneously polishing the conductive material from the field regions using a pad material attached to an anode, wherein the depositing and polishing rates are essentially the same;

(2) increasing the depositing rate over the polishing rate after the cavities are completely filled with the conductive material; and

(3) forming the uniform overburden conductive layer on the substrate.

23. A method according to claim 22, wherein step (1) comprises depositing the conductive material on the substrate at current density of $10\text{mA}/\text{cm}^2$ to $10.5\text{mA}/\text{cm}^2$ between the anode the substrate.

24. A method according to claim 22, wherein the uniform overburden
5 conductive layer ranges from 0.1 to 10000 Å.

25. A method for depositing a conductive material in the cavities of a substrate having a barrier layer formed thereon, the method comprising the steps of:

forming an oxide layer on certain portions of the barrier layer that resides on the top surface of the substrate, while preventing the oxide layer from being formed on other
10 portions of the barrier layer that resides in the cavities;

depositing the conductive material on the entire substrate, the conductive material being formed primarily in the cavities of the substrate.

26. A method according to claim 25, wherein the step of forming the oxide layer on certain portions of the barrier layer comprises the step of anodizing the barrier
15 layer on the top surface of the substrate.

27. A method according to claim 25, wherein the step of preventing the oxide layer from being formed on the barrier layer in the cavities comprises the step of forming an insulating layer on the barrier layer in the cavities.

28. A method for depositing a conductive material in the cavities of a
20 substrate having a barrier layer and a seed layer formed thereon, the method comprising the steps of:

depositing a chrome layer over the seed layer;

depositing a silicon dioxide layer over the chrome layer;

removing the silicon dioxide layer, the chrome layer, and the seed layer from the field regions of the substrate while preventing removal of the silicon dioxide layer and the chrome layer from the cavities of the substrate;

removing the silicon dioxide layer from the cavities using a dilute HF solution;

5 and

depositing the conductive material in the cavities of the substrate.

29. An electrolyte solution used for depositing a conductive material in the cavities of a substrate while preventing the conductive material from being formed on the field regions of the substrate, the solution comprising a source of metal ions, a source of current carriers, a source form chloride ions, a source leveling additives, metal oxidizing agents, passivating agents, and sufactants.

30. A solution according to claim 29, wherein the metal ion concentration comprises $\frac{1}{2}$ to 40 g/L, the acid concentration comprises 0.05 to 18 % by volume, the chloride ion concentration comprises 2-180 ppm, the leveling additive concentration comprises 0.1 to 60 g/L, the passivating agent concentratrion comprises 0.0005 to .1M, and the surfactant concentration comprises 20 to 800 ppm.